

SWARMING BEHAVIOUR IN NATURE AND COLONY
FORMATION UNDER LABORATORY CONDITIONS IN
ODONTOTERMES MICRODENTATUS ROONWAL &
SEN-SARMA AND *ODONTOTERMES OBESUS*
(RAMBUR) (ISOPTERA: TERMITIDAE)¹

V. B. AGARWAL²

INTRODUCTION

Swarming behaviour and colony foundation in primitive termites have been studied in detail by Pickins (1934), Buchli (1950), Herfs (1951), Lüscher (1951), Roonwal & Sen-Sarma (1955), Weesner (1956), Wilkinson (1962) and Nutting (1965, 1966) and on higher termites some observations have been recorded by Williams (1959), Arora & Gilotra (1959), Sen-Sarma (1962) and Sands (1965). However, besides those of Arora & Gilotra (1959) and Sen-Sarma (1959), no other study seems to exist in the literature on the nuptial flight and colony foundation in the higher fungus growing termites of India. The present study was taken up in order to fill up this lacuna.

MATERIAL AND METHODS

For field studies wire mesh tents were put up for two years covering five mounds of *O. microdentatus* and five mounds of *O. obesus* every year in the month of January and February. The wire mesh tents did not interfere with either ventilation or wetting of the mounds during the rains, thus maintaining the normal

natural conditions. After the start of monsoon rains, observations were taken daily in order to note the actual swarming date.

OBSERVATION AND DISCUSSION

In Dehradun, swarming of both species was noticed inside the wire mesh tents in the third week of June (17th) at 23 hr in 1973 and in the fourth week of June (26th) at 5 hr in 1974, which coincided with the date and time of swarming that took place in other uncovered mounds existing in the vicinity. The swarming was preceded by a good shower of rain and continued for six hours in 1973 while in 1974 it was not preceded by rain but at the time of swarming, the sky was overcast with dark clouds and the light was dull. The air temperature and the relative humidity at the time of swarming ranged from 24.2 to 24.9°C and 95% r.h. in 1973 and 20.9 to 21.8°C and 80% r.h. in 1974 which may provide major stimulus for initiating the flight period (Nutting 1965). For purpose of swarming only a few (4-8) vents were made by the workers mostly on the top of the mound connecting it to a wider chamber (Probably acting as the launching platform) in *O. microdentatus*. In

¹ Accepted April 1977.

This is a part of the thesis approved by the Meerut University for the Ph.D. Degree. The work was carried out in the Forest Entomology Branch

of Forest Research Institute & Colleges, Dehradun.

² Northern Regional Station, Zoological Survey of India, Dehra Dun (U.P.).

case of *O. obesus*, the vents were made in the hollow shafts of the mound. No holes on the ground as reported by Mathur & Sen-Sarma (1962) in *O. obesus* were observed in either *O. microdentatus* or in *O. obesus*.

No fixed time for swarming as reported by Harris (1958) in *O. badius* (one hour after sunset) and Sen-Sarma (1962) in *O. assmuthi* (at 4.30 p.m.) was observed. Only a single swarm was observed in a year. Single swarming in a year has also been recorded in *O. obesus* (Annandale 1923, Beeson 1941, Arora & Gilotra 1959, Mathur & Sen-Sarma 1962 and Roonwal 1970) and in *O. assmuthi* (Sen-Sarma 1962). This is in contrast to the swarming habits of the primitive termites where two or more swarming per year have been recorded (Herfs 1951, Roonwal & Sen-Sarma 1955, Harris 1950 and Nutting 1965, 1966). The swarming of few alates at a time in primitive termites has the advantage of reducing the chances of predation. This is necessary as the population in these termitaries is comparatively lower than in the termitaries belonging to *Odontotermes*.

The alates were collected from wire mesh tents as well as at light. Each sample comprised of about 200 alates. On an average, the male-female proportion in samples collected from wire mesh tents was 21.2% and 78.8% in *O. microdentatus*, and 28.1% and 71.9% in *O. obesus*. In the samples collected from light, the average male: female proportion was 22.1% and 77.9% in *O. microdentatus*, and 25.5% and 74.5% in *O. obesus*. Sands (1965) in five species of *Trinervitermes* also observed that in swarms, females were predominant in number over the males. However, an extreme case of male predominance was reported by Uchanco (1919) in *Microtermes gilvus philippinensis* (95% and 5% in the swarm). Thus it is significant to note that male:female do not exhibit the typical 1:1 ratio.

Dealation: The process of dealation was studied in the fields as well as in the laboratory. The alates after the dispersal flight settled down on the ground or bushes and cast off their wings by raising the abdomen frequently and rubbing it against rough surfaces which causes breaking of the wings at the basal suture.

In the laboratory more than 100 alates of each species mostly with wings intact, were kept overnight in large glass troughs. It was observed that majority of alates had not shed their wings and they congregated at one corner of the glass trough. Wings were, however, shed when the alates were transferred singly or in pair to separate glass troughs. The alates were observed to shed their wings within 5 to 7 minutes after their separation from the group. The inhibitory factor against the shedding of wings in alates when kept together in the laboratory seems to be due to the crowding of alates which simulated the conditions in the nest. That the isolation of the individuals from the group seems to be needed to stimulate dealation was also observed in *Anacanthotermes ochraceus* (Clement 1956) and in *O. assmuthi* (Sen-Sarma 1962).

Calling attitude: Female alates were observed to adopt calling attitude only after the dealation. The abdomen of the female was characteristically raised at an angle of 30° from the horizontal plane. Females move their abdomen laterally rather violently. The abdominal movement was stopped as soon as contact with the male was established. The male thus, seems to use visual clue in locating the female. It was further observed that if the male was withdrawn after the contact or was lost, the calling attitude was again adopted by the female.

Tandem behaviour: With the approach of males, the females stop movement of abdomen

SWARMING BEHAVIOUR OF TWO TERMITE SPECIES

and start moving forward with the males following in tandem very closely. The following males caressed the anal tip of female by means of their antennae. Duration of tandem lasted 10-15 minutes. Only female-male tandem was observed. Neither the male-female tandem as observed by Lüscher (1951) in *Kaloterme*s and *Cryptoterme*s nor tandem comprising only one sex was observed. The pair ultimately settled down by preparing a small chamber in soil matrix on the side of the trough. This indicates thigmotactic response and return to photonegative behaviour.

Colony foundation: For colony foundation in the laboratory, pairs of both species in tandem were released in medium sized round glass troughs filled up with 15 to 20 cm deep moist soil. A few holes were made in the matrix. Water was added as and when needed. These troughs were kept in the cellar having a temperature of $28^{\circ}\text{C} \pm 1^{\circ}\text{C}$ and 90% \pm 5% relative humidity. The female with the following males entered slowly into the holes, went deep and ultimately prepared a copularium. The tunnel connecting the cell to the outside was sealed up immediately. As the alates cannot take food by themselves, the pair apparently live on the food reserves in their body, till the hatched workers grew up to feed them. Out of 100 pairs 50 for *O. microdentatus*

and 50 for *O. obesus* released in the glass troughs, only twenty two pairs survived, ten from *O. microdentatus* and twelve from *O. obesus* and laid the eggs. The preoviposition period was about 11-13 days. The female laid 14-16 eggs in the first batch and 24-28 eggs in the second batch on the following days. Females were observed to lay eggs continuously and the number of eggs laid increased progressively. Eggs adhered together by means of a jelly like fluid.

First batch of eggs hatched out after 40 days in *O. microdentatus* and after 40-43 days in *O. obesus*. Period from hatching to development of mature workers was 32 days in *O. microdentatus* and 30 days in *O. obesus*. First batch of workers were relatively smaller in size. The development of soldier caste could not be observed as the colonies died after ninety two days.

ACKNOWLEDGEMENTS

The investigation was carried out under the guidance of Dr. P. K. Sen-Sarma. I am also grateful to the President, Forest Research Institute & Colleges, Dehradun for permission to conduct the work. My thanks are also due to Dr. B. K. Bakshi, D.B.R. and Sri Pratap Singh for encouragement.

REFERENCES

- ANNANDALE, N. (1923): The fauna of an island in the Chilka Lake. The habits of the termites of Barkuda Island. *Rec. Indian Mus.*, Calcutta, 25:233-251.
- ARORA, G. L. & GILOTRA, S. K. (1959): The biology of *Odontotermes obesus* (Rambur). *Res. Bull. Punjab Univ. Sci.*, Chandigarh, 10:247-255.
- BEESON, C. F. C. (1941): The ecology and control of forest insects of Indian and neighbouring countries. The Vasant Press, Dehra Dun, India, pp. 1-1007.
- BUCHLI, H. R. (1950): Recherches sur la foundation et la development des nouvelles colonies chez la termite lucifuge (*Reticulitermes lucifugus* Rossi). *Physiologia Comp. Oecol.*, The Hague, 2:145-160.
- CLEMENT, G. (1956): Observations sur L'essaimage d' *Anacanthotermes ochraceus* Burm. (Isoptera). *Bull. Soc. ent. Fr.*, Paris, 61:98-103.
- HARRIS, W. V. (1958): Colony formation in the Isoptera. *Proc. 10th Int. Congr. Ent.*, Montreal, 2: 435-439.
- HERFS, A. (1951): Der Schwarmflug von *Reticu-*

- littermes lucifugus* Rossi. *Z. Angew. Ent.*, Berlin, 83: 69-77.
- LÜSCHER, M. (1951): *Beobachtungen über Koloniegriindung bei Verschiedenen afrikanischen termitenarten—Acta trop.* Basel, 2:36-43.
- MATHUR, R. N. & SEN-SARMA, P. K. (1962): Notes on the habits and biology of Dehradun termites. *J. Timb. Dry. Pressrv Ass., India*, Dehradun, 8: 1-18.
- NUTTING, W. L. (1965): Observation on the nesting site and biology of the arizona damp wood termite *Zootermopsis laticeps* (Banks) (*Hodotermitidae*). *Psyche*, Berkeley, 72:113-125.
- (1966): Colonizing flights and associated activities of termite *Paraneotermes simplicicornis* (Kalotermitidae). *Psyche*, Berkeley 73: 131-149.
- PICKENS, A. L. (1934): The biology and economic significance of the western subterranean termites, *Reticulitermes hesperus*. In "Termites and Termite control" (C. A. Kofoid ed.) 2nd ed. Univ. California Press, Berkeley, California: pp. 157-183.
- ROONWAL, M. L. (1970): Termites of the oriental region. In "Biology of Termites" Vol. II (K. Krishna & F. M. Weesner, ed.). Academic Press, New York & London: pp. 315-384.
- ROONWAL, M. L. & SEN-SARMA, P. K. (1955): Biology and ecology of oriental termites (Isoptera). No. 3, Some observations on *Neotermes* (Snyder). *J. Bombay nat. Hist. Soc.*, 53:234-239.
- SANDS, W. A. (1965): Alate development and colony foundation in five species of *Trinervitermes* Isoptera, Nasutitermitinae in Nigeria, West Africa. *Insects Soc.* Paris, 12:117-130.
- SEN-SARMA, P. K. (1962): Some observations on swarming in nature and colony foundation under laboratory conditions in *Odontotermes assmuthi* (Holmgren) at Dehradun (Isoptera: Termitidae). *Beitr. Ent.*, Berlin, 12:292-297.
- UCHANCO, L. B. (1919): General facts in the Biology of Philippine mound building termites. *Philipp. J. Sci.*, Manilla, 15:59-65.
- WEESNER, F. M. (1956): The biology of colony foundation in *Reticulitermes hesperus* Banks. *Univ. Calif. Publ. Zool.*, California, 61:253-314.
- WILKINSON, W. (1962): Dispersal of alates and establishment of new colonies in *Cryptotermes havilandi* (Sjostdt) (Isoptera, Kalotermitidae). *Bull. ent. Res.*, London, 53:265-286.